Volpe Human Factors Support to PTC RSAC Activities

- HRA report on CBTM
- HRA analysis of NAJPTC System
- Identify roadway worker issues related to new technology

HRA Analysis of NAJPTC

- Participate on Risk 2 Panel to identify baseline risk scenarios
- Provide guidance in evaluating HMI components of PSP and risk assessment
  - Provide guidance on HMI issues that could significantly impact risk

HRA Analysis Activities

- Task analysis and failure mode analysis
- Review human factors literature to learn how these failure modes addressed
- Rank operational scenarios where problems appear most likely
- Recommend ways for quantifying human errors based upon existing methods.

Roadway Worker Issues Associated with New Technologies: Background

- Impact of PTC technologies on roadway workers was raised as an issue at the last RSAC Meeting
- The FRA has initiated a project to address this issue:
  - Objective: Identify PTC Human Factors issues as they impact roadway worker performance and safety
  - Initial Task: Elicit input from Roadway Worker Representatives on RSAC Committee
  - Conference call held August 23 with Tim DePaepe, BRS; Robin Buxton, IBE; Kent Turner, BMWE (for Rick Inclima).

Questions Posed

- Impact of introduction of PTC on roadway workers:
  - Changes to how roadway workers currently do their jobs?
  - Potential new performance challenges?
  - Potential new error modes/sources of risk?
- Anticipated benefits of PTC systems
  - PTC features particularly targeted at roadway workers?
  - Increased roadway worker safety?
- Other Issues of Concerns

Points of Consensus

- Difficult to project potential impact due to limited knowledge and experience with PTC systems:
  - roadway workers have had little (if any) involvement in the development of PTC systems
  - as a result are unable to project in detail:
    - how PTC systems will impact roadway workers
    - what new error modes might arise
- Can identify human factors issues of concern based on experience with introduction of other new technologies
  - e.g., portable transponders, smart interlockings, smart crossing monitors, ACESS system

Impact of New Technology (in general) on Roadway Workers

- New technology is likely to substantially change how roadway workers do their jobs:
  - New knowledge and skill requirements (to test, maintain, and repair more sophisticated software/hardware).
  - New training requirements -- often only a subset of personnel are trained, with the result that the person sent out to do a repair may not be familiar with the system.
  - Need to keep track hardware/software upgrades and ‘lessons learned’ from the field.
  - Possibility for new errors that introduce failures into the system.

Anticipated Benefits of PTC Systems

- Improved protection of roadway workers
  - Keeping trains and equipment from coming into work zones without authority
  - Reducing the possibility of ‘train-to-train’ collisions, and thus reducing exposure of roadway workers to HAZMAT and other hazards (e.g., diesel fuel)
- Equipment intended for use by roadway workers (e.g., GPS installed on high rail vehicles; portable transponders)

Other Issues Raised

- Importance of designing transparent systems that provide clear feedback of operational status:
  - Concerned that roadway workers may develop a false sense of security (believing a system is providing protection in cases where it is not operational -- due to human error or system malfunction)
- Concern that there are likely to be unanticipated failure modes
- Need to preserve redundant backup systems
- Need for improved inter-craft communication and coordination.

Broader implications for implementing new technology

- **Design process**:
  - Are systems designed to be easy to understand (transparent) and control?
  - Are ease of maintenance issues being considered in the design?
  - Is roadway worker input being solicited as part of the design process?
- **Organizational infrastructure**:
  - What type of training will be provided and to whom?
  - What processes and procedures will be put into place to insure that roadway workers are kept informed of software/hardware changes and lessons learned from the field?
  - Will existing ‘backup’ systems be preserved to guard against unanticipated failure modes?
  - Have ‘lessons learned’ from the introduction of other new technologies been considered in developing a ‘roll-out’ plan?

Proposed Approach to Address Human Factors Concerns Relative to Roadway Workers

- Identify contributors to performance problems and sources of errors for roadway workers in current operations as input to design and evaluation of new PTC systems.
- Identify lessons learned from the introduction of other train control technologies (e.g., ITCS, ACESS, CBTM).
- Understand and document plans of current PTC developers relative to roadway workers.